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(54) **SYSTEMS AND METHOD FOR IDENTIFYING AND MITIGATING INFORMATION SECURITY RISKS**

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CPC **H04L 63/1441** (2013.01); **G06F 21/577** (2013.01); **H04L 51/046** (2013.01); **H04L 63/14** (2013.01); **H04L 63/1483** (2013.01); **G06Q 10/107** (2013.01); **H04L 51/28** (2013.01)

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CPC H04L 63/1483; H04L 63/1441; G06Q 10/107

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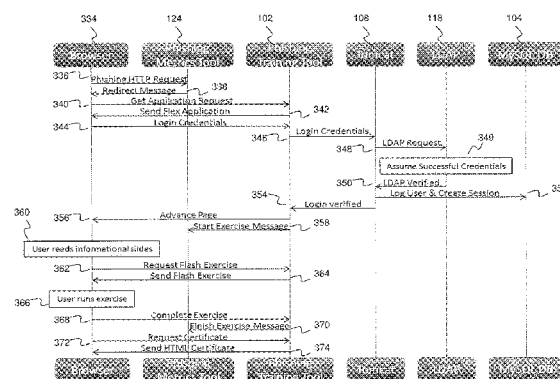
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(57) **ABSTRACT**

Methods and systems for Sustained Testing and Awareness Refresh against Phishing threats (STAR*Phish™) are disclosed. In an embodiment, a method assigns schemes and unique identifiers to target e-mail addresses associated with a user accounts. The method delivers e-mail messages to the targeted e-mail addresses, the e-mail messages comprising an HTTP request and a unique identifier associated with each of the user accounts. The method then receives, at a Phishing Metric Tool (PMT), a response including the unique identifier. The PMT logs training requirements for the user accounts, tracks response metrics for the training requirements, and redirects the respective HTTP requests to a phishing training tool (PTT). The PTT sends a notification of the user account identities and the unique identifiers to the PMT and returns a status for the training requirements for the user accounts. Upon completion of the training, the PMT sends completion notifications for the user accounts.

20 Claims, 14 Drawing Sheets



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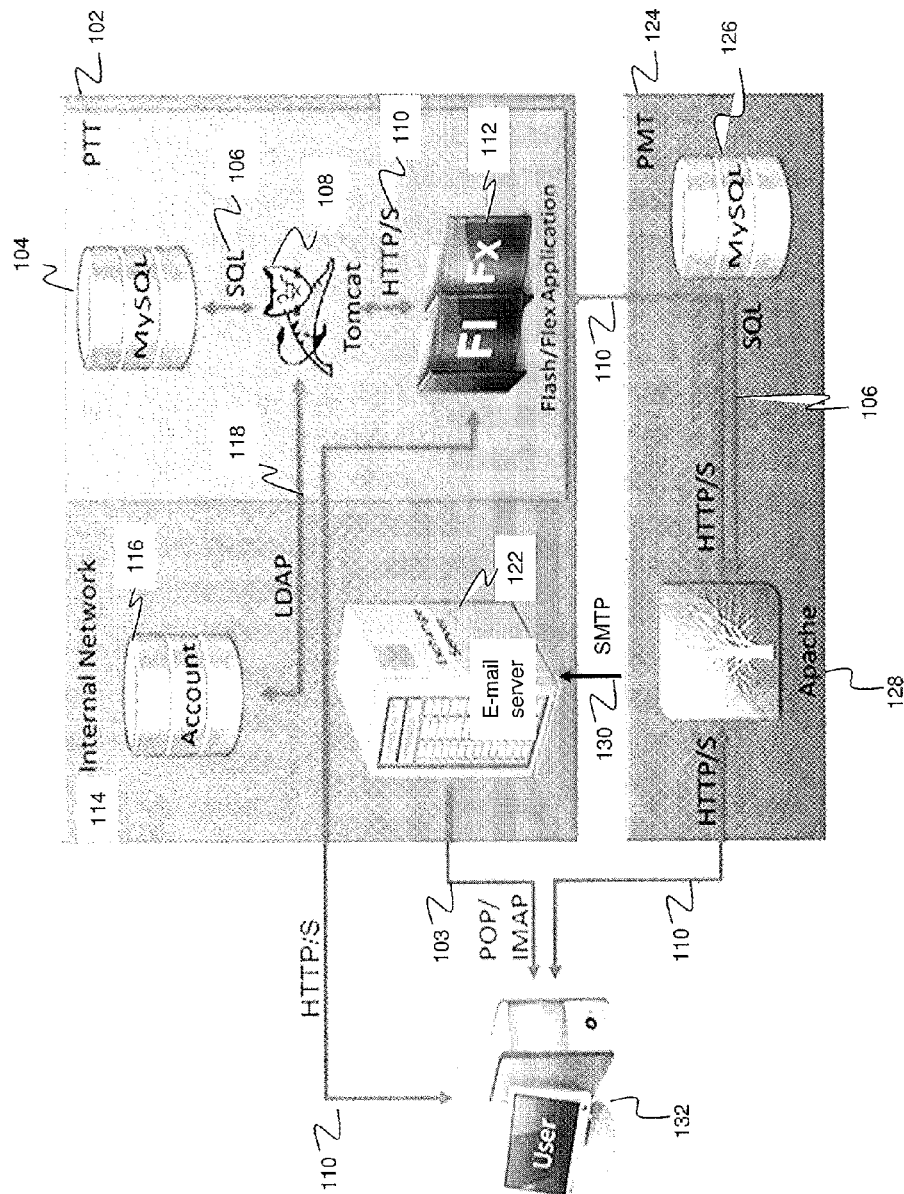
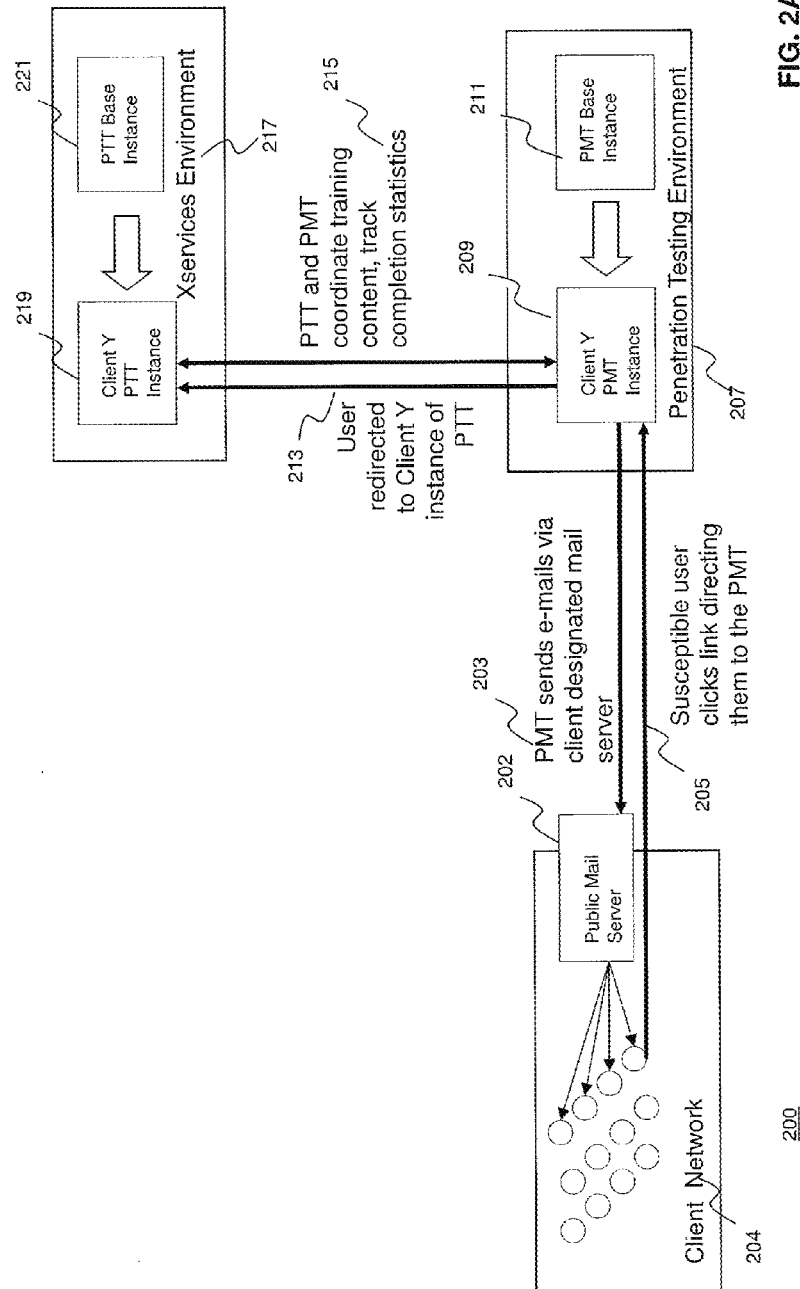


FIG. 1

Process Diagram without Distributed Phishing Agents (DPAs)



Process Diagram with Distributed Phishing Agents (DPAs)

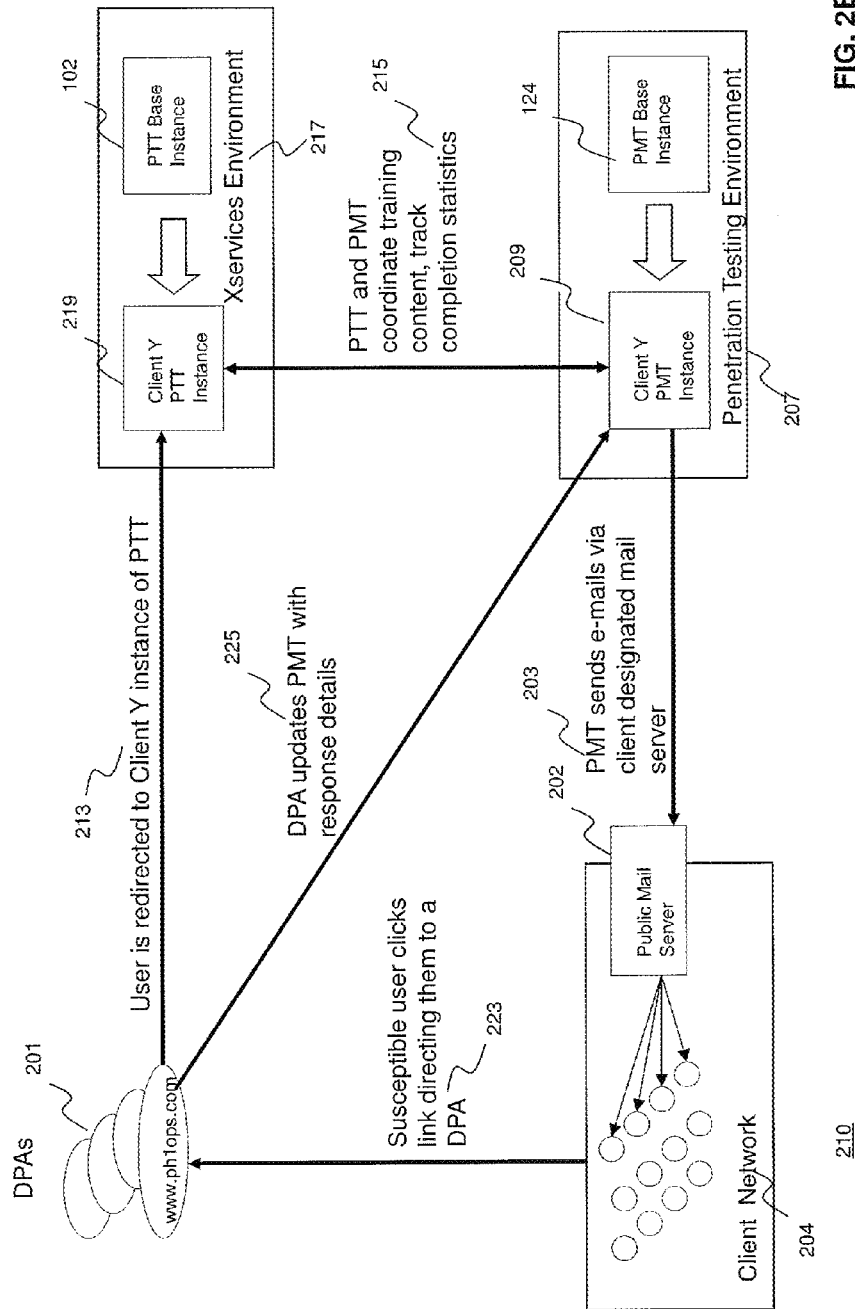


FIG. 2B

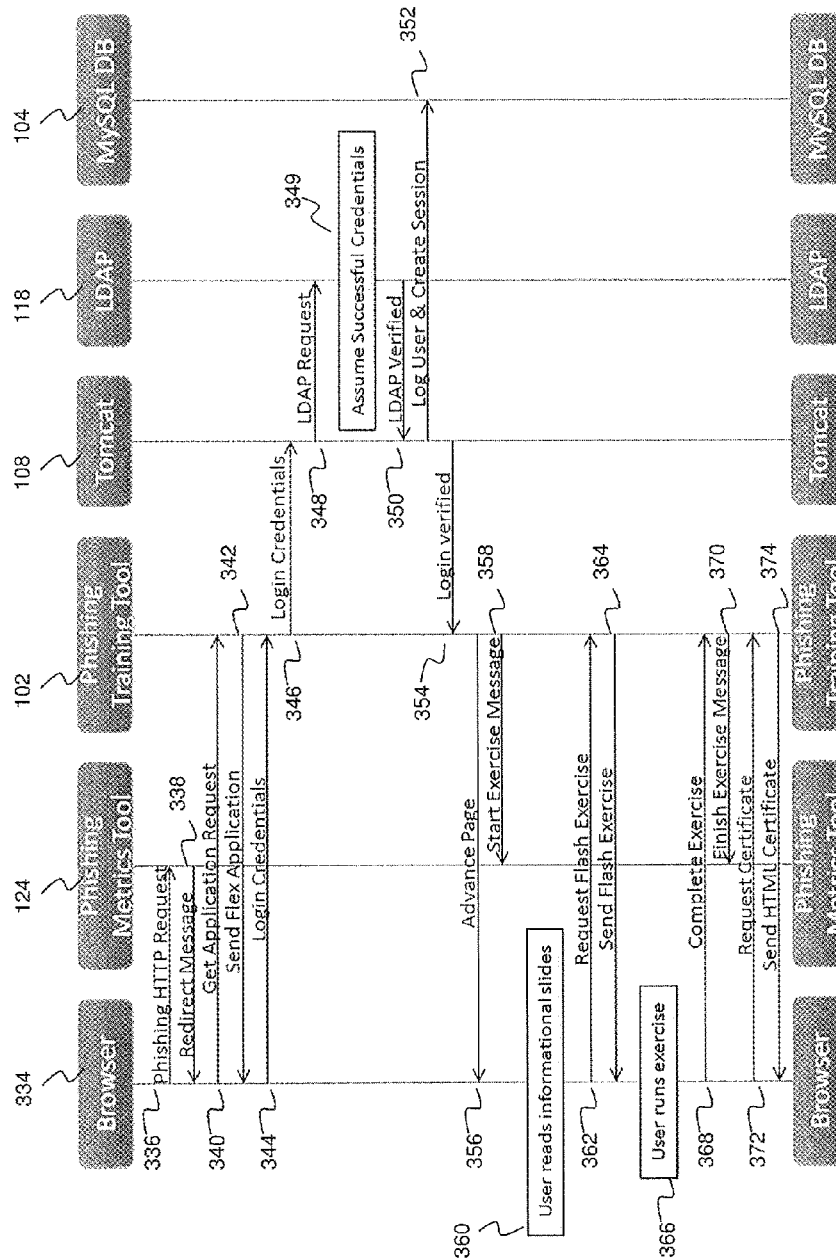


FIG. 3

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Server Side Administrative Interface

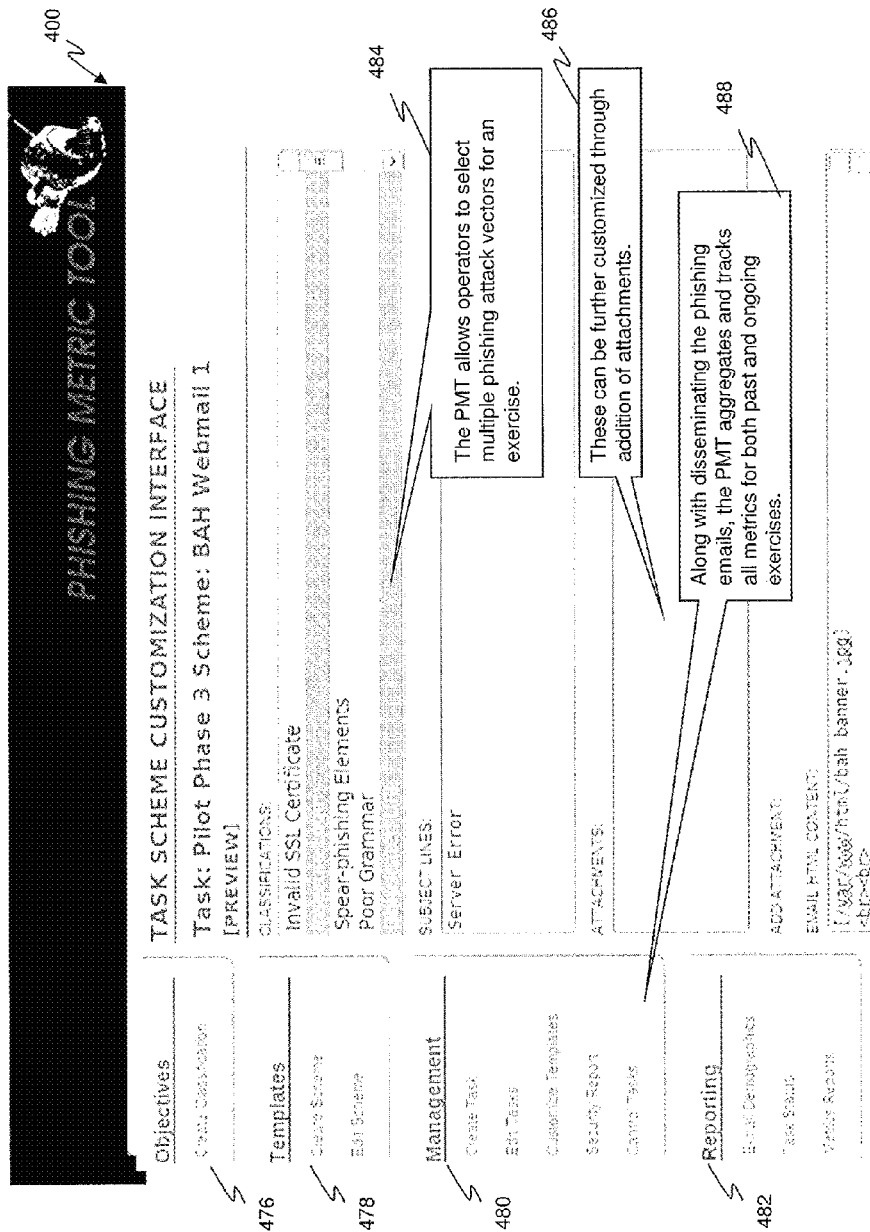


FIG. 4

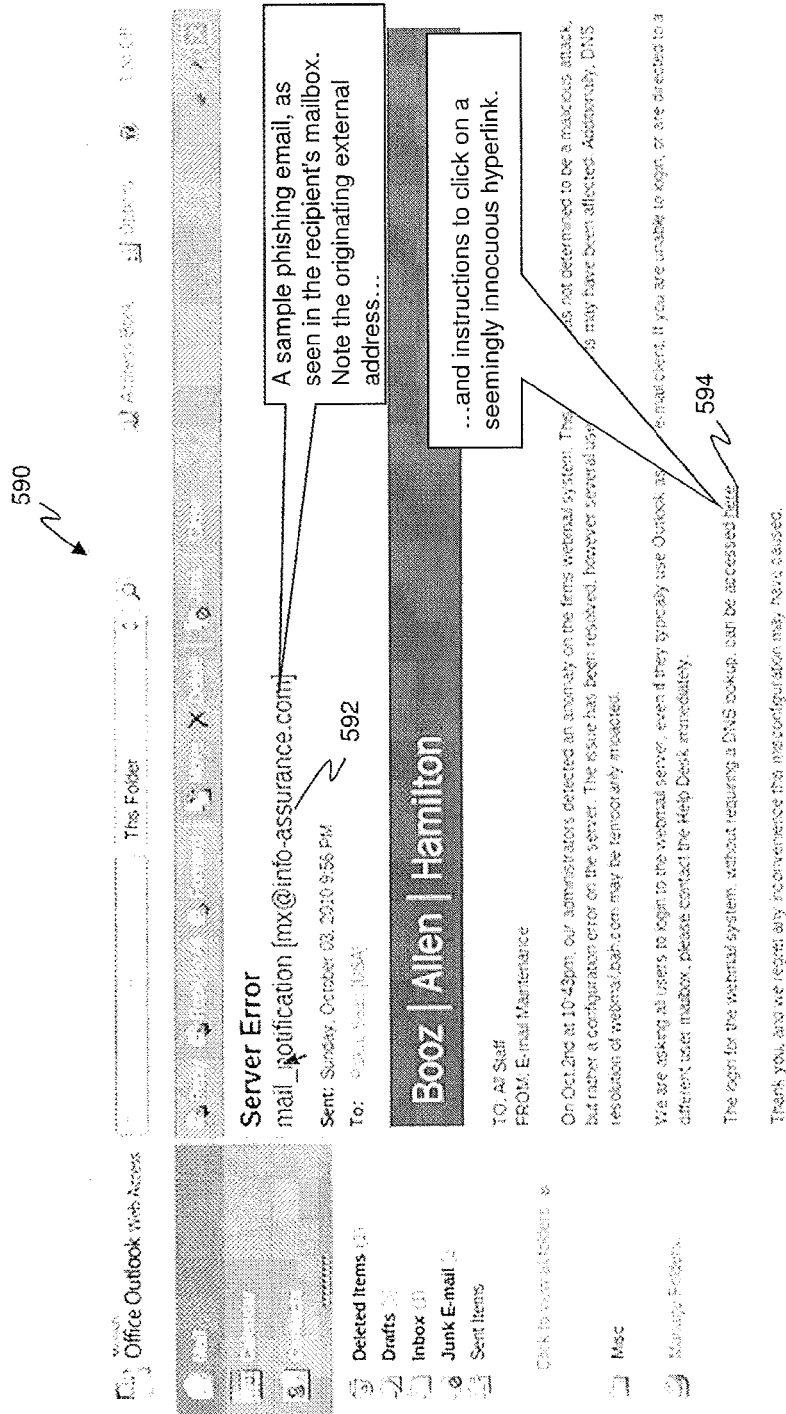
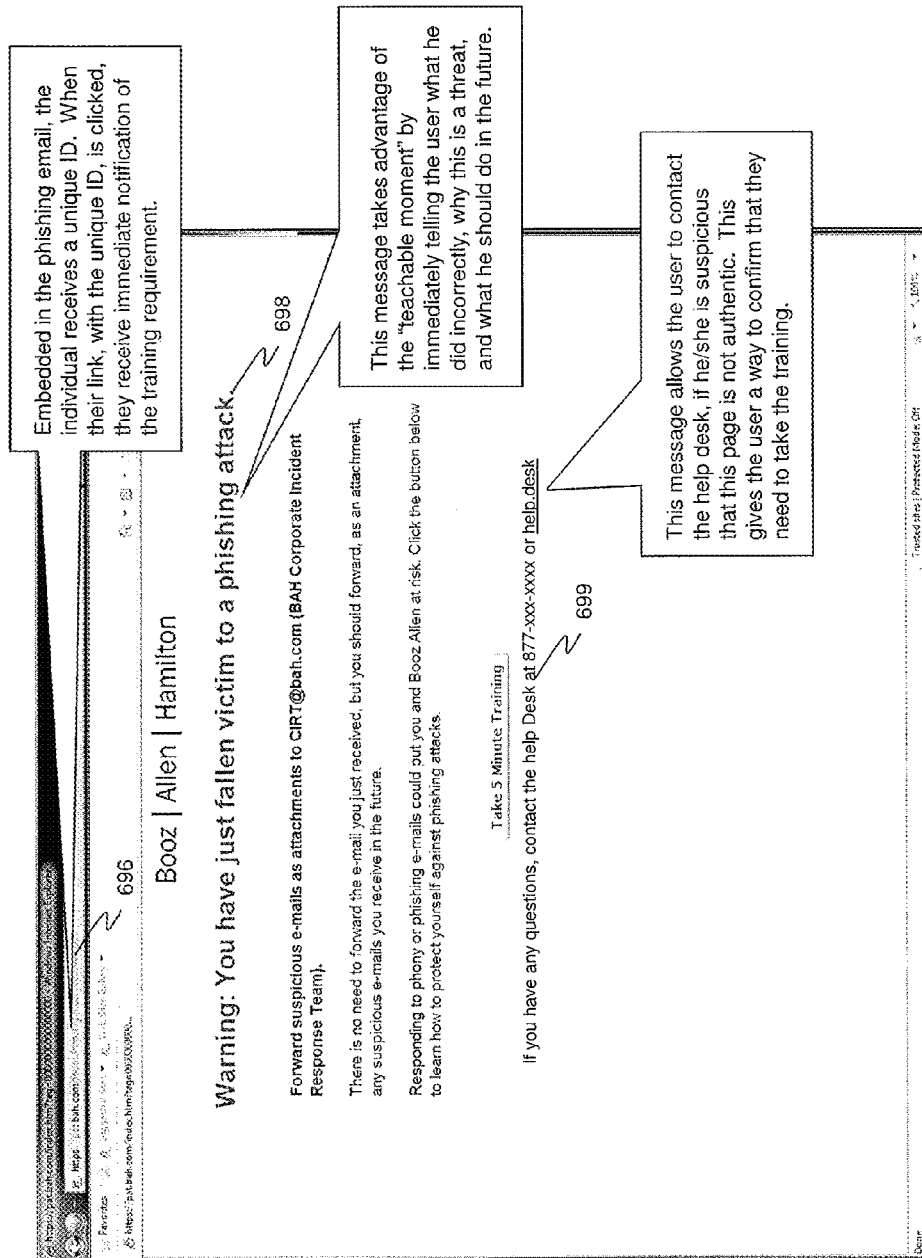


FIG. 5



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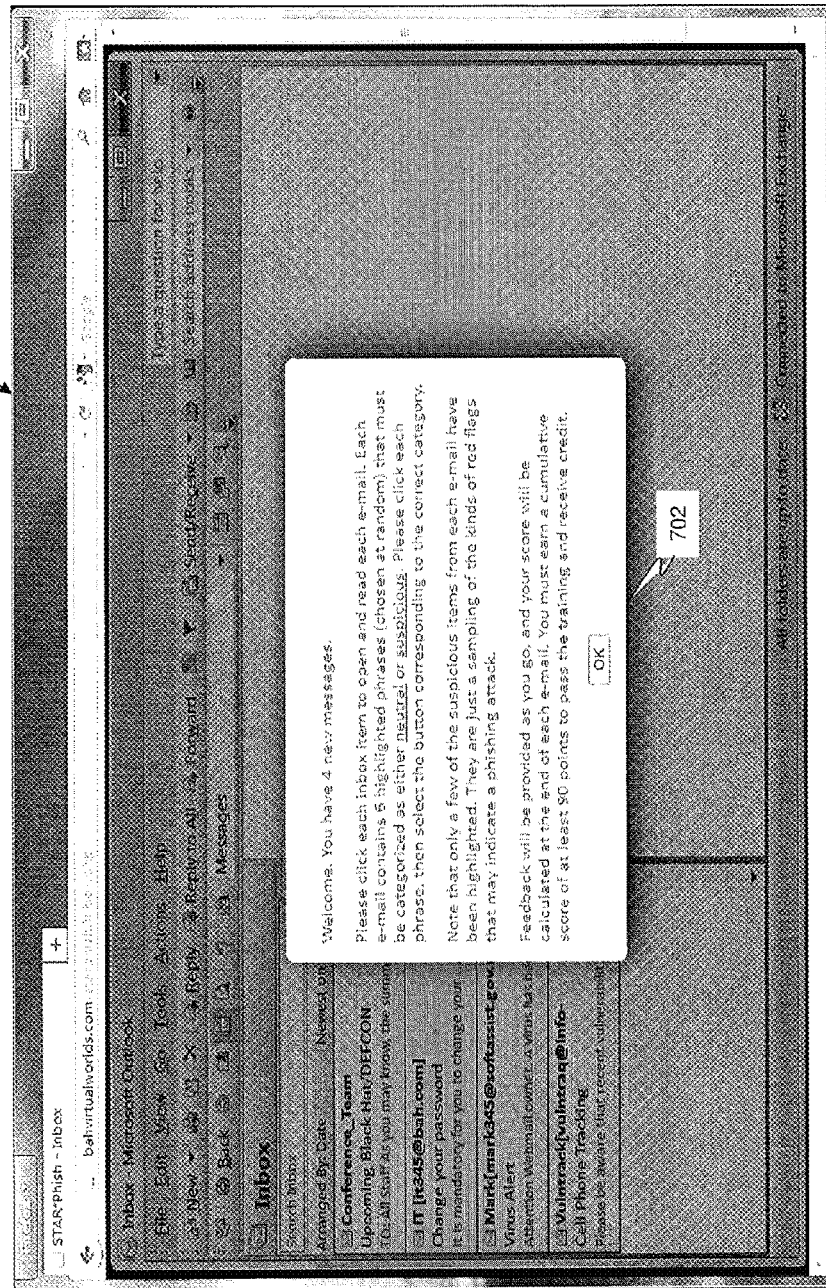
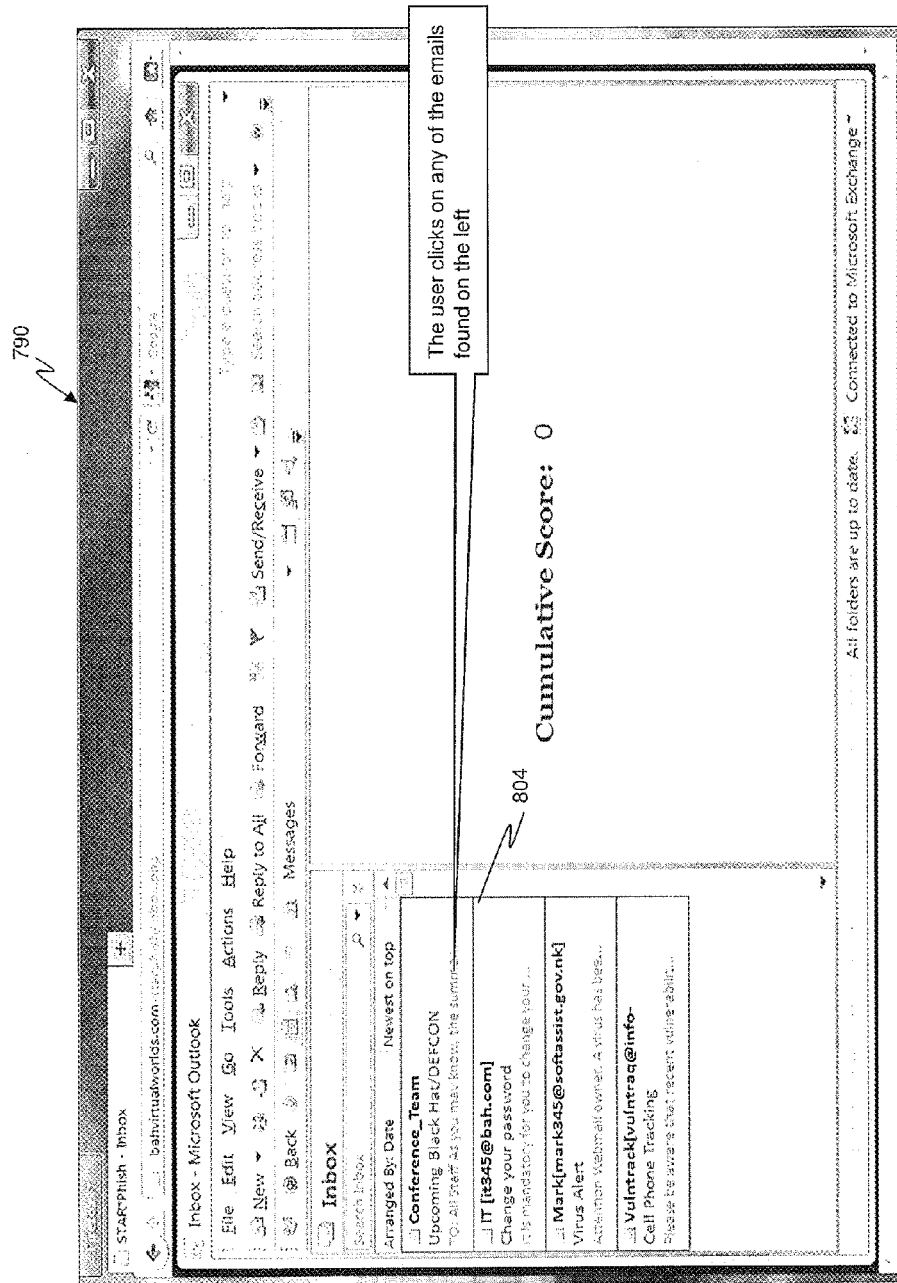


FIG. 7



8
G.
E.



Fig. 9

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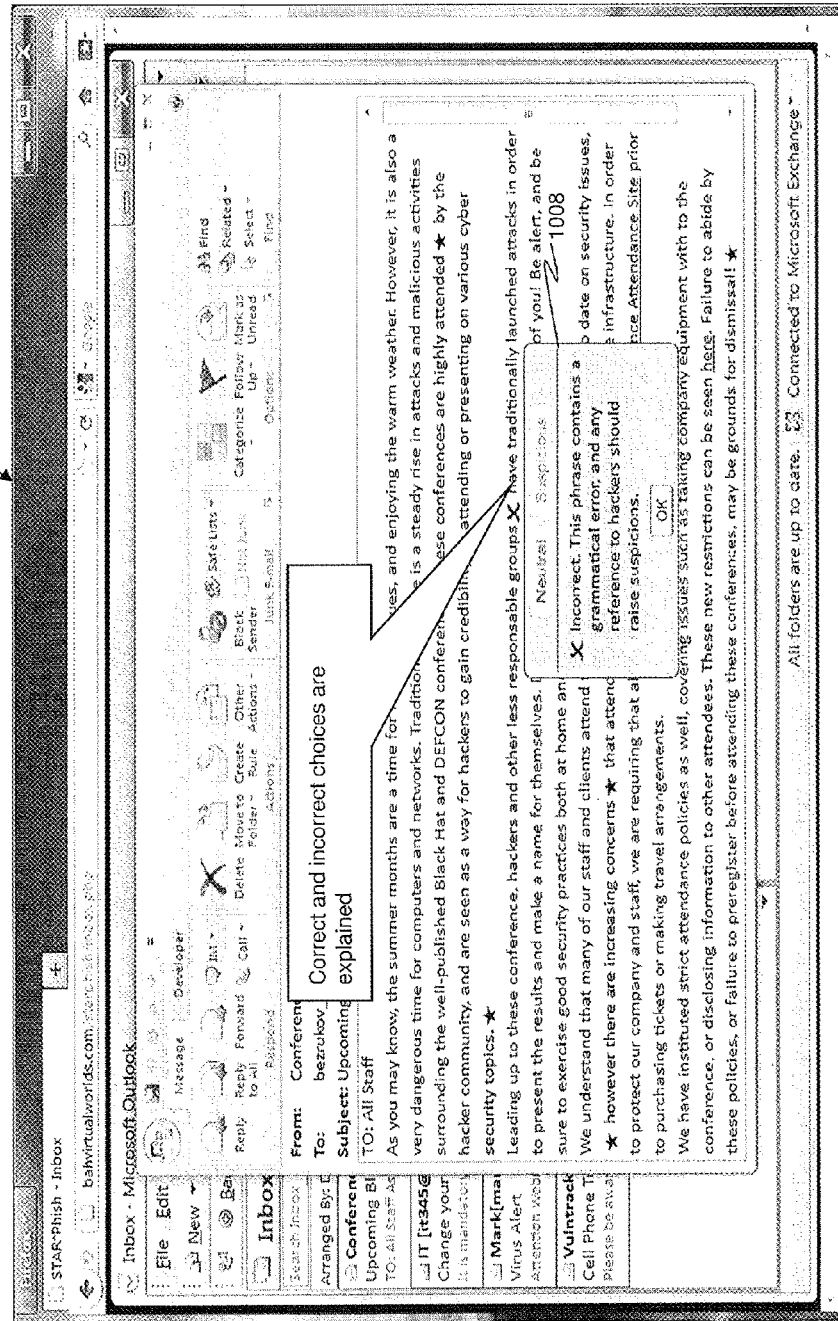


FIG. 10

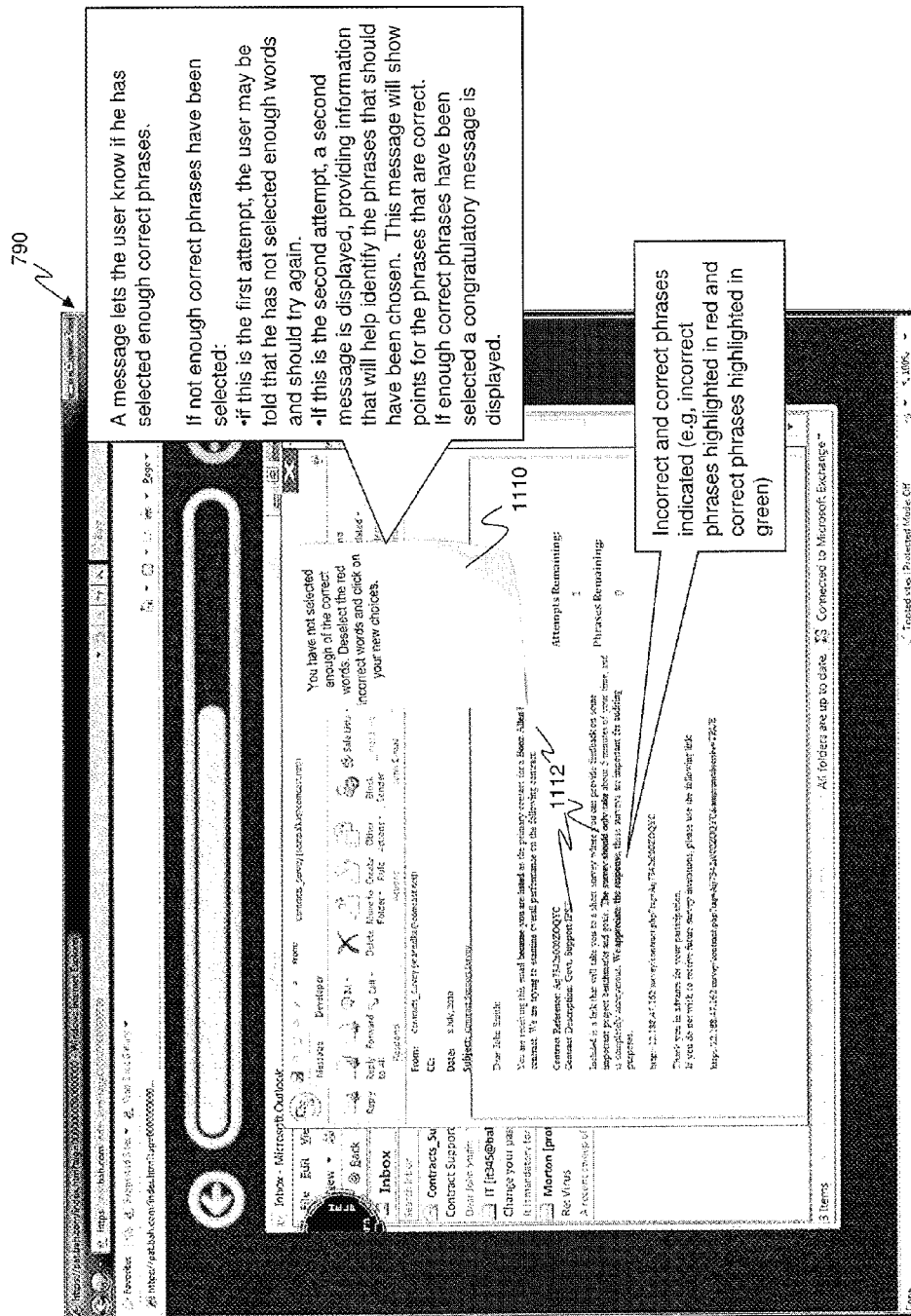


FIG. 11

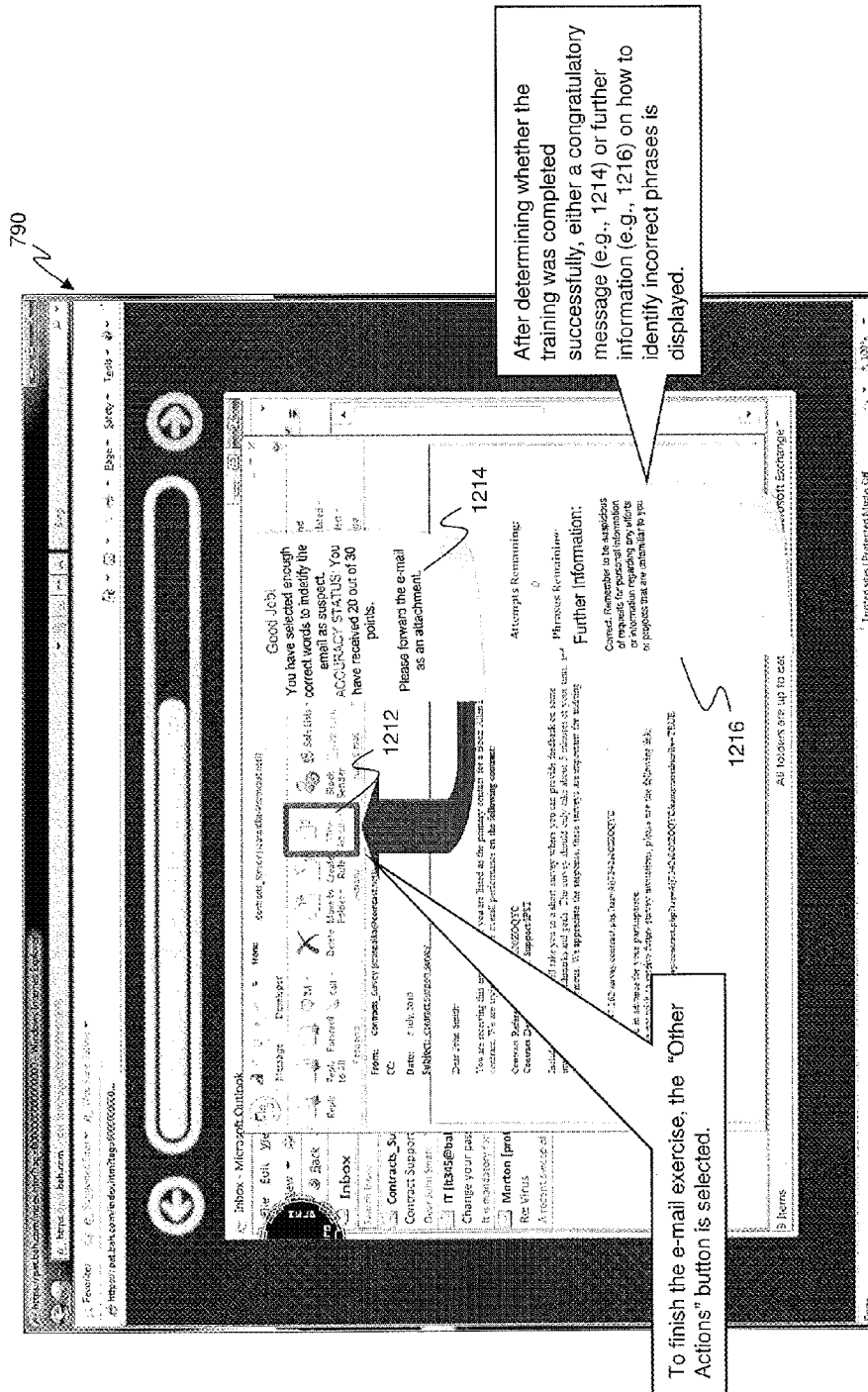


FIG. 12

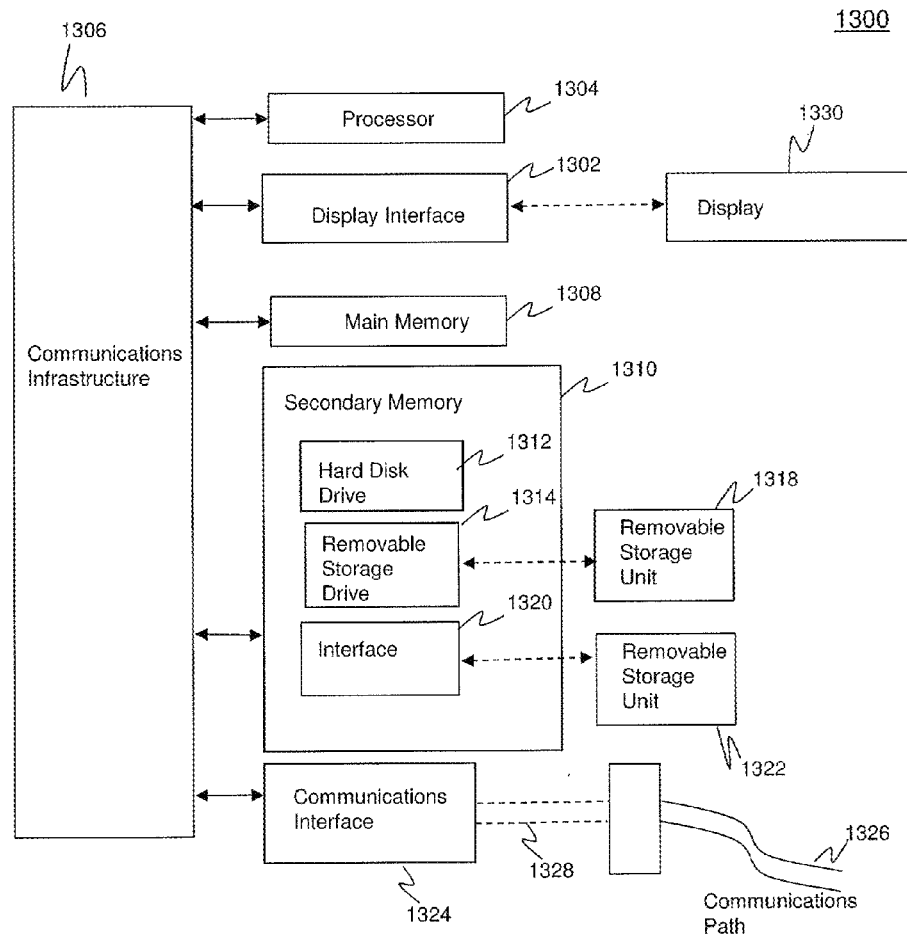


FIG. 13

1

SYSTEMS AND METHOD FOR IDENTIFYING AND MITIGATING INFORMATION SECURITY RISKS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 13/297,570 filed on Nov. 16, 2011, claims priority to U.S. Provisional Application No. 61/414,142, filed on Nov. 16, 2010, and U.S. Provisional Application No. 61/502,678, filed on Jun. 29, 2011. The entire contents of these prior applications are incorporated by reference in their entireties.

BACKGROUND OF THE DISCLOSURE

1. Field of the Disclosure

The field of the disclosure relates generally to information security training, and, more particularly, to phishing awareness training.

2. Description of the Related Art

Social engineering attacks, such as phishing, constitute a common threat to organization's information technology (IT) enterprise systems and data. Phishing attacks target individual users and seek to exploit them as the weakest link in the information security chain.

Conventional information security training consists of static presentations or test events that are exercised on a periodic basis (i.e., annually, quarterly, or monthly). However, given that attack methodologies are constantly evolving, information security threats quickly outpace the level of conventional training. This is especially true in the social engineering attack context. Accordingly, what is needed is more sophisticated information security training to better protect organizations and their data from these ever-evolving threats.

Traditional training techniques, such as annual data security training, are not targeted to susceptible users and fail to provide a consistent level of user awareness of security threats such as social engineering attacks. Accordingly, what is needed are systems and methods for providing a consistent level of user awareness and exploitation of a "teachable moment" operand conditioning in order to provide focused training for susceptible users.

SUMMARY OF THE DISCLOSURE

The present disclosure is directed to exemplary methods, exemplary apparatus and exemplary systems that provide phishing awareness training to targeted users.

Based on service-oriented design, exemplary embodiments of the present disclosure provide awareness on evolving threats as they are detected, rather than waiting for annual or quarterly training efforts. Additionally, exemplary embodiments disclosed herein provide tailored exercises which can be geared towards specific staff, such as new hires or contractors. Metrics from exercises can be tracked over time to determine the effectiveness of training across various objectives and organizational demographics as well.

Additionally, tailored exercises can be geared towards specific, targeted user accounts, such as, but not limited to, user accounts associated with new hires, contractors, or users who have demonstrated a propensity for falling victim to social engineering attacks, either simulated or real, in the past.

Techniques for Sustained Testing and Awareness Refresh against Phishing threats (STAR*Phish™) disclosed herein are distinguishable from conventional techniques in several ways. One key premise of the systems and methods disclosed

2

herein is to focus on exploiting a "teachable moment" to target training towards susceptible users, which is an emerging concept that the training systems described herein are built around. In accordance with an exemplary embodiment, users are trained in live exercises coordinated with incident response personnel, and those users who fall victim are immediately transferred to a training component. According to an exemplary embodiment, STAR*Phish™ includes two components: a Phishing Metrics Tool (PMT), and a Phishing Training Tool (PTT).

While training provides an engaging environment to learn about various attack methodologies used in phishing, it is also tailored to reinforce correct reporting procedures. In the course of training, users are shown the correct and safe way to report phishing, which goes beyond what most available training resources currently provide. While providing information on the threat, STAR*Phish™ also provides information on responding to the threat within the environment the user operates in.

This response process is customized to client policies and procedures, rather than an ambiguous response approach that might not be relevant for all users. STAR*Phish™ takes a unique approach from an architectural standpoint as well, by providing a dual-domain system. According to an embodiment, the PMT is hosted on an external, un-trusted domain which lends credibility to the security threat for all responses. According to this example embodiment, users are actually clicking on links and being directed to websites that are external to their organization's environment, rather than accessing a simulated capture site inside their own, trusted environment. However, the PMT directs users to training which is located on a trusted internal site associated with their organization. In this way, the "bait" provides a high level of realism, but once the response is captured users are provided training on a trusted domain. This increases the likelihood that users will continue with their training requirement, rather than assuming the training is part of a phishing attack.

The PMT provides several unique capabilities. First, the phishing exercises allow phishing e-mails to be customized, including a wide variety of attacks such as attachments and full credential captures. The responses, and the "teachable moment", can be caught at varying stages depending on the objectives of the exercise. For example, users can be directed to training immediately after clicking a link, or can be allowed to enter credentials or run embedded code before being transferred to training. Additionally, the metrics being tracked by the PMT are extremely diverse and not currently provided in such depth by conventional training systems. The PMT tracks response types, shows response graphs based on IP and target email, illustrates geographic distributions of responses, and even uses heuristics to determine social network maps and potential administrative hosts. The PMT also has an agent-based design that can be used to run distributed phishing exercises according to client requirements. Agents can be used to distribute phishing e-mails, track responses, and update a central collection agent that tracks the metrics.

Finally, STAR*Phish™ is modular, and can be tailored to meet specific client needs. If requested, the PMT can be used to run stand-alone exercises as part of penetration tests, or the PTT can be implemented to provide a stand-alone training resource.

In an embodiment, a computer-implemented method for training disclosed herein provides distinguishing features not found in conventional training systems. In accordance with an exemplary embodiment, there are two ways that users can take the training: voluntarily or as part of a mandatory requirement. Voluntary training is promoted through social

media, including communities of practice and demonstrations. In accordance with an exemplary embodiment, users are provided with an ADOBE™ Flash-based training simulation that provides a virtual e-mail client interface, mimicking what they are likely to use in normal operations. In an alternative exemplary embodiment, the training simulation is ADOBE™ Flex-based. In yet another alternative exemplary embodiment, the training simulation is implemented in the HTML5 language.

If users have been directed to the training as a result of responding to a phishing e-mail, they are immediately trained on the e-mail that they were targeted with, capitalizing on the threat to which they have responded. Additionally, the mandatory training component is tracked as part of the live exercises, and users are sent notifications of their training requirement. This notification system, incorporated into the PMT, prevents users from simply ignoring poor security practices.

The present disclosure is directed to exemplary systems, architectures, methods, and non-transitory computer readable storage media for implementing STAR*Phish™.

Further features and advantages of the present disclosure, as well as the structure and operation of various embodiments thereof, are described in detail below with reference to the accompanying drawings. It is noted that the present disclosure is not limited to the specific embodiments described herein. Such embodiments are presented herein for illustrative purposes only. Additional embodiments will be apparent to persons skilled in the relevant art(s) based on the teachings contained herein.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

The accompanying drawings, which are incorporated herein and form part of the specification, illustrate exemplary embodiments of the present disclosure and, together with the description, further serve to explain principles, aspects and features of the present disclosure. The exemplary embodiments are best understood from the following detailed description when read in conjunction with the accompanying drawings. It is emphasized that, according to common practice, the various features of the drawings are not to scale. On the contrary, the dimensions of the various features are arbitrarily expanded or reduced for clarity. Included in the drawings are the following figures:

FIG. 1 illustrates a modular view of an enterprise environment for identifying and mitigating information security risks, in accordance with an exemplary embodiment of the present disclosure;

FIG. 2A depicts a process diagram for identifying and mitigating information security risks in an architecture without distributed phishing agents, in accordance with an exemplary embodiment of the present disclosure;

FIG. 2B depicts a process diagram for identifying and mitigating information security risks in an architecture with distributed phishing agents, in accordance with an exemplary embodiment of the present disclosure;

FIG. 3 provides a Message Sequence Chart illustrating operational steps by which information security risks are identified and mitigated, in accordance with exemplary embodiments of the present disclosure;

FIG. 4 depicts a server-side administrative graphical user interface (GUI) for a phishing metric tool (PMT), according to an exemplary embodiment of the present disclosure;

FIGS. 5-6 depict a GUI for an email client to display and receive notification of susceptibility to a phishing attack, according to an exemplary embodiment of the present disclosure;

FIGS. 7-12 depict a GUI for displaying and completing a received phishing training exercise, according to an exemplary embodiment of the present disclosure;

FIG. 13 is a diagram of an exemplary computer system in which embodiments of the present disclosure can be implemented.

The features and advantages of the present disclosure will become more apparent from the detailed description set forth below when taken in conjunction with the drawings, in which like reference characters identify corresponding elements throughout. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. Generally, the drawing in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number.

DETAILED DESCRIPTION

The present disclosure relates to systems and methods for providing sustained testing and awareness against social engineering threats to information security, such as phishing threats. In particular, the systems and methods provide sustained user awareness training mechanism in a continuous, ongoing fashion and within a Web 2.0 training environment with live phishing exercises. In contrast to traditional periodic (e.g., annual) training, the systems and methods of the present disclosure provide a consistent level of user awareness and exploit “teachable moment” operand conditioning in order to provide focused training for users susceptible to social engineering attacks. Based on its service-oriented design, an exemplary system is able to provide awareness on evolving threats as they are detected, instead of waiting for an annual or quarterly training course. Additionally, tailored exercises delivered by the system can be geared towards specific staff, such as new hires or contractors. Metrics from the exercises can be tracked over time to determine effectiveness of training across various objectives and organizational demographics as well.

Embodiments of the systems and methods disclosed herein provide focused phishing awareness training wherein “teachable moments” are exploited so as to provide focused training for users that have demonstrated susceptibility to phishing. The systems and methods also adapt to evolving threats by including live exercises that are performed regularly with escalated complexity based on the level of user awareness demonstrated in previously-completed exercises. In embodiments, metrics from the exercises are tracked over time to determine the effectiveness of training across various objectives and organizational demographics. Embodiments also include customized training including components that can be implemented separately or in tandem to meet an organization’s specific needs by merging testing and training components.

According to embodiments disclosed herein, live training exercises are coordinated using the PMT to allow testers to develop and send convincing, realistic phishing e-mail messages, track responses in real-time, and analyze and track metrics such as, but not limited to, response rates. As user responses are tracked by the PMT, teachable moments are exploited to train users while actions and perceptions are still fresh. In an embodiment, individual exercise components can be run without training to establish base metrics. Alternatively, exercise components can be included as part of an

5

organization's penetration testing, which analyzes the impact of successful phishing attacks.

The methods and systems disclosed herein offer a training simulation that provides an engaging and informative environment that walks users through identification of suspicious e-mail messages and reinforces organizational reporting procedures. Embodiments of the training require users to be fully engaged so that they are not merely clicking through and acknowledging a pre-determined sequence of screens. The training can be offered as a stand-alone component as well as a voluntary training resource. Through sustained use of the training, as opposed to traditional periodic training offered at set times, evolving threats are addressed and users are provided with consistent training opportunities that maintain user awareness at all times.

While the present disclosure is described herein with reference to illustrative embodiments for particular applications, it is to be understood that the invention is not limited thereto. Those skilled in the art with access to the teachings provided herein will recognize additional modifications, applications, and embodiments within the scope thereof and additional fields in which the invention would be of significant utility.

Unless specifically stated differently, in an embodiment, a user is interchangeably used herein to identify a human user, a software agent, or a group of users and/or software agents. Besides a human user who may be susceptible to information security breaches and phishing threats, a software application or agent sometimes can fall prey to information security attacks. Accordingly, unless specifically stated, the terms "user" and "user account" as used herein do not necessarily pertain to a human being.

FIG. 1 depicts an enterprise system 100, which allows a user account 132 to connect to web server 128 via Hypertext Transfer Protocol (HTTP) and Hypertext Transfer Protocol Secure (HTTPS) requests 110, in accordance with an embodiment of the present disclosure. While this embodiment is described chiefly in terms of a connection between a user account 132 from a client machine and web server 128, it is applicable to other servers such as e-mail server 122. Although web server 128 is depicted as an Apache web server, as will be appreciated by persons skilled in the relevant art, web server 128 may be implemented as another Hypertext Transfer Protocol (HTTP) web server. Similarly, while servlet 108 is depicted in FIG. 1 as an Apache Tomcat servlet, those skilled in the relevant art will appreciate that servlet 108 is not limited to being implemented as a Tomcat servlet.

System 100 utilizes a unique combination of training tied to a phishing exercise (e.g., a simulated attack via email messages). Phishing exercises, such as the ADOBE™ Flex and Flash training application 112 depicted in FIG. 1, utilize a unique identifier to track responses to specific crafted emails. The identifier allows reliable metrics, such as, but not limited to, geographic location, tracking, as well as association of user accounts 132 and their responses to specific exercises. In one embodiment, the identifier is a 16 digit number that forms part of a uniform resource locator (URL) sent as an HTTP request redirect. In another embodiment, the identifier may be a parameter passed with email messages and HTTP redirect messages.

PTT 102/PMT 124 communications include the unique identifier in order to enable tracking of logins for user accounts 132 and training status. An update process allows PTT 102 to retrieve specific exercise e-mails from PMT 124 and include these in the training for targeted user accounts 132.

System 100 has multiple components, each with a highly specialized function. The Phishing Training Tool (PTT) 102

6

is a data-driven training interface that is used to train susceptible users. In an embodiment, the Phishing Metrics Tool (PMT) 124 is a web-based content development and management interface that is used to generate phishing e-mails, such as Post Office Protocol (POP) and Internet message access protocol (IMAP) e-mail messages 103, and track responses.

Deployment of system 100 for an organization entails customizing the components depicted in FIG. 1 to meet organizational training directives and aesthetics. Additionally, while no sensitive data is stored in system 100, individual instances of PMT 124 and PTT 102 are created to support a given organization, allowing for segregation of response statistics.

In order to provide realistic phishing exercises, in certain embodiments some aspect of the phishing exercise architecture for system 100 may reside on an untrusted domain external to the internal network 114 of the organization. For example, PMT 124, its PMT database server 126, and its web server 128, may reside on an untrusted domain external to internal network 114 and PTT database server 104 and e-mail server 122, which each reside on a trusted domain. As described below with reference to FIG. 2B, the use of Distributed Phishing Agents (DPAs), which can be registered on an untrusted domain for components of PMT 124, can lend additional realism to the training exercise by making web server 128 and PMT database server 126 appear to be truly external to internal network 114 and the user's trusted domain.

Although PTT and PMT database servers 104 and 126 are shown in the exemplary embodiment of FIG. 1 as MySQL servers, as will be appreciated by persons skilled in the relevant art, database servers 104 and 126 may also host other relational database management systems (RDBMSs), such as, but not limited to, Oracle™ database servers, servers hosting MICROSOFT™ SQL Server databases, and Sybase™ database servers. Similarly, while exemplary e-mail server 122 is shown as a MICROSOFT™ Exchange server, those skilled in the relevant art will appreciate that the e-mail server 122 may also be implemented as other e-mail servers, such as, but not limited to a Lotus Domino server, a Lotus Notes server, and a Novell GroupWise.

With continued reference to FIG. 1, the functionality of the components of system 100 are described below. The communications and relationships between the components of system 100 are described within the context of a computer-implemented method for providing sustained testing and awareness refresh training against social engineering threats to information security. Although the computer implemented method is described with reference to interactive computer-based training that improves an organization's awareness of phishing attacks, it is understood that the method can be applied to identifying and mitigating threats from other social engineering attacks. The steps of the computer implemented method do not necessarily have to occur in the order described below. As noted below, some of the steps are optional.

The method begins when target e-mail addresses for user accounts 132 are respectively assigned schemes and unique identifiers by PMT 124. In an embodiment, structured query language (SQL) statements 106 are sent between PMT database server 126 and web server 128 within PMT 124 to accomplish the assignment of schemes and unique identifiers.

Next, e-mail messages are delivered to user accounts 132 with respective unique identifiers. As shown in the exemplary embodiment of FIG. 1, this may be accomplished by sending Simple Mail Transfer Protocol (SMTP) requests 130 from web server 128 to e-mail server 122. The e-mail messages are

then downloaded by the user accounts **132**. In an embodiment, this may be done via POP/IMAP e-mail messages **103** sent via e-mail server **122**.

Then, a vulnerable user logged into a user account **132** supplies a response to PMT **124** via an HTTP/HTTPS request **110** to web server **128**. The HTTP/HTTPS request **110** includes the unique identifier discussed above. At this point, PMT **124** updates a status for the responding user account **132**, logs a training requirement, and tracks response metrics for user account **132**. As illustrated in FIG. 1, the status update, logging and metrics tracking can be accomplished by sending SQL statements **106** between PMT database server **126** and web server **128**.

Next, the user associated with user account **132** is redirected to PTT **102** in real-time immediately after capturing the response, thus exploiting a “teachable moment” while the user’s susceptibility to the simulated phishing attack is fresh in his mind. This re-direct can be accomplished by sending an HTTP/HTTPS redirect request **110** from to user account **132** from training application **112** within PTT **102**. Although training application **112** is depicted in as an ADOBE™ Flex or Flash application, it is understood that training application **112** can be implemented in other development environments and languages, such as, but not limited to, HTML5.

As an optional step, user account **132** may be directed to PTT **102** via another HTTP/HTTPS request **110** from the training application **112** after a reminder notification has been sent. User account **132** may also be sent an HTTP/HTTPS response **110** from the training application **112** via web server **128** for voluntary training. In another optional step, user credentials for user account **132** are sent via a Lightweight Directory Access Protocol (LDAP) request **118** from servlet **108** to account database **116** within internal network **114**. These user credentials can then be validated, providing confirmation of the identity of a user account **132** respondent. Next, PTT **102** sends notification of respondent identity and identifier to PMT **124** via an HTTP/HTTPS response **110**.

During the execution of training application **112** by the user associated with user account **132**, PMT **124** iteratively updates the training status and returns training exercise e-mail contents as applicable. According to one embodiment, this can be done by sending SQL statements **106** between PMT database server **126** and web server **128**.

As an optional step, PMT **124** may send a reminder notification in response to determining that a user associated with a user account **132** does not complete the training within a designated time period. This notification can be sent via POP/IMAP e-mail messages **103** from e-mail server **122** to user account **132**. In embodiments, the designated time period is a tunable parameter that can be adjusted by a training or system administrator of internal network **114**. For example, the time period may be set to a predetermined number of hours, days, or weeks, as deemed necessary by the administrator.

Upon determining that the training has been completed by the user associated with user account **132**, PTT **102** sends a completion notification. This notification can be sent as an HTTP/HTTPS response **110** between training application **112** and web server **128**. In one embodiment, this step may additionally include generation and display of a completion certificate by training application **112**. According to embodiments, the completion notification and/or certificate can be sent to user account **132** and an administrator for internal network **114**.

Lastly, PMT **124** updates the status for user account **132** and sends a completion e-mail message to user account **132**.

As shown in FIG. 1, this completion e-mail message can be sent as an SMTP request **130** from web server **128** via e-mail server **122**.

FIGS. 2A and 2B depict exemplary architectures and process diagrams for identifying and mitigating information security risks in an architecture without and with distributed phishing agents, respectively, in accordance with embodiments of the present disclosure. FIGS. 2A and 2B are described with continued reference to the embodiments illustrated in FIG. 1. However, FIGS. 2A and 2B are not limited to those embodiments.

As part of coordination tasks, an organization (i.e., “Client Y”) in the exemplary embodiments of FIGS. 2A and 2B) in need of phishing awareness training may supply information about a valid e-mail server **122**, such as public mail server **202**, that can be used to send e-mails to user accounts **132** within client network **204**.

In accordance with an embodiment, customized version of the base instance of PTT **102**, such as the client Y PTT instance **219** depicted in FIG. 2A, is deployed in Xservices environment **217**. This allows trusted communications by deploying valid Secure Sockets Layer (SSL) certificates, plus the reliability of a hosted environment like Xservices environment **217**.

As shown in FIG. 2A, in architecture **200** without distributed phishing agents, an isolated instance of the base instance of PMT **124** is deployed as a client Y PMT instance **209** on Penetration Testing Environment **207**. This allows simulated attacks without compromising internal security policies. This isolated instance is shown in FIG. 2A as Client Y PMT instance **209**.

Client Y PMT instance **209** sends e-mail messages **203** to a client-designated mail server, such as public mail server **202**. Next, a susceptible user associated with a user account **132** within client network **204** clicks on a simulated phishing link/URL, triggering an HTTP/HTTPS request **205** to client Y PMT instance **209**. According to an embodiment, client network **204** may be internal network **114** described above with reference to FIG. 1.

At this point, user account **132** is redirected to Client Y PTT instance **219** via an HTTP/HTTPS redirect request **213**. Next, client Y PTT instance **219** and client Y PMT instance **209** coordinate training content and track completion statistics. As illustrated in FIG. 2A and described with reference to FIG. 1 above, this coordination can be accomplished by sending HTTP/HTTPS requests and responses **215** between client Y PTT instance **219** and client Y PMT instance **209**.

FIG. 2B depicts an architecture **210** and process diagram for identifying and mitigating information security risks in an architecture with distributed phishing agents, in accordance with an embodiment of the present disclosure.

Within architecture **210**, Distributed Phishing Agents (DPA) **201** are registered domains with no traceable connection to the host organization or internal network **114**, and serve as proxies for capturing responses. According to an embodiment, DPAs **201** are registered domains that act as proxies that redirect users to appropriate resources, allowing the exercises to use a variety of links and avoid altered responses based on recognition of target uniform resource locators (URLs).

As shown in FIG. 2B, client Y PMT instance **209** sends e-mail messages **203** to a client-designated mail server, such as public mail server **202**. Next, a susceptible user associated with a user account **132** within client network **204** clicks on a simulated phishing link/URL, triggering an HTTP/HTTPS request **223** to a DPA **201**. According to an embodiment,

client network 204 may be internal network 114 described above with reference to FIG. 1, but the DPAs 201 are external to client network 204.

Next, the user associated with user account 132 is redirected to client Y PTT instance 219 via an HTTP/HTTPS redirect 213 sent from the DPA 201 to client Y PTT instance 219. As shown in FIG. 2B, DPA 201 also updates client Y PMT instant 209 with response details 225 for user account 132.

At this point in the process, client Y PTT instance 219 and client Y PMT instant 209 coordinate training content, track completion statistics. As illustrated in FIG. 2B described above with reference to FIGS. 1 and 2A above, this coordination can be accomplished by sending HTTP/HTTPS requests and responses 215 between client Y PTT instance 219 and client Y PMT instant 209.

FIG. 3 is a message sequence chart illustrating a method 300 of sustained testing and awareness refresh against phishing threats in accordance with other exemplary embodiments.

FIG. 3 is described with continued reference to the embodiments illustrated in FIGS. 1, 2A and 2B. However, FIG. 3 is not limited to those embodiments.

Method 300 handles cases where a phishing HTTP request is sent from a browser session in response to a susceptible user clicking on a simulated phishing link. According to an embodiment, the browser session may be an Internet browser web-based e-mail client launched by a user associated with a user account 132 to read e-mail delivered by e-mail server 122.

Method 300 begins at step 336 where a phishing HTTP/HTTPS request is sent from browser 334 to PMT 124. As would be understood by persons skilled in the relevant art, the method 300 can be applied to various Internet browsers, including, but not limited to, MICROSOFT™ Internet Explorer, Mozilla Firefox, GOOGLE™ Chrome, APPLE Safari, and OPERA™.

In step 338, a redirect message is sent from PMT 124 to browser 334 so that in step 340, an application request can be sent from browser 334 to PTT 102. The request sent in step 340 can be for any embodiment of training application 112 described above with reference to FIG. 1.

In step 342, training application 112 is sent from PTT 102 to browser 334. Although training application 112 is shown in FIG. 3 as an ADOBE™ Flex application, as described above with reference to FIG. 1 and step 340, in alternative embodiments, training application can be an ADOBE™ Flash application or an application developed in other environments/languages such as HTML5.

In steps 344-354, which are included in an optional login process within method 300, login credentials for user account 132 are sent and verified.

In step 344, login credentials for user account 132 are sent from browser 334 to PTT 102, which in turn forwards the credentials to servlet 108 in step 346. While servlet 108 is depicted in FIG. 3 as an Apache Tomcat servlet, those skilled in the relevant art will appreciate that servlet 108 is not limited to being implemented as a Tomcat servlet.

In step 348, an LDAP request 118 is sent by servlet 108 so that the credentials can be successfully verified in step 349. As described above with reference to FIG. 1, credential verification in this step may include checking the credentials against an account database 116 within internal network 114.

In step 350, an LDAP-verification status is sent to servlet 108 so that the user account 132 can be logged in and a user session can be created in step 352.

In step 354, an indication of the verified login is sent from servlet 108 to PTT 102.

In step 356, an advance page is sent from PTT 102 to browser 334. In an embodiment, this advance page indicates in the browser session that a training exercise is required.

In step 358, a start exercise message is sent from PTT 102 to PMT 124. According to an embodiment, the start exercise message includes a unique identifier uniquely identifying the user account 132 that needs to complete the exercise provided by training application 112.

In step 360, the user associated with user account 132 can review informational slides regarding the exercise, which are displayed by browser 334.

In step 362, a request for the exercise is sent from browser 334 to PTT 102. Although the exercise is shown as an ADOBE™ Flex-based exercise in FIG. 3, it is to be understood that the exercise can be ADOBE™ Flash-based or developed using other languages such as, but not limited to, HTML5.

In step 364, the exercise is sent from PTT 102 to browser 334 so that the user associated with user account 132 can run the exercise on browser 334 in step 366.

In step 368, upon completion of the exercise, a completion notification is sent from browser 334 to PTT 102 and in response, PTT 102 sends an exercise completion message to PMT 124 in step 370.

In step 372, the user associated with user account 132 can optionally send a request from browser 334 to PTT 102 so that PTT 102 can send an HTML completion certificate back to browser 334 in step 374.

FIGS. 4-12 depict example graphical user interfaces (GUIs) for displaying and information pertaining to sustained testing and awareness refresh against phishing threats. In an embodiment, a server side administrator application may include the exemplary interface illustrated in FIG. 4.

According to an embodiment, browser 334 may display the exemplary interface illustrated in FIGS. 5-12. FIGS. 4-12 are described with continued reference to the embodiments illustrated in FIGS. 1-3. However, FIGS. 5-12 are not limited to those embodiments. Throughout FIGS. 5-12, displays are shown with various hyperlinks, command regions, tabs, buttons, checkboxes, and data entry fields, which are used to initiate action, invoke routines, enter data, view data, or invoke other functionality, such as functionality of training application 112. For brevity, only the differences occurring within the figures, as compared to previous or subsequent ones of the figures, are described below.

FIG. 4 illustrates an exemplary GUI for viewing and editing task scheme information within a server side administrative interface, in accordance with an embodiment of the present disclosure. FIG. 4 illustrates a top-level administrative interface 400 for displaying and editing training settings associated with PMT 124. Administrative interface 400 is a server side administrative interface used to customize task schemes, such as the schemes described with reference to FIG. 1 above.

By clicking create classification link 476, an administrator for internal network 114 can create a classification for a training exercise. By selecting template links 478, the administrator can create and edit schemes. FIG. 4 also includes management links 480, which allow the administrator to create and edit training tasks in addition to customizing templates. Management links 480 also allow security reports to be viewed and edited and enable viewing and modification of control tasks.

Along with disseminating the phishing e-mail messages, PMT 124 can aggregate and track metrics for both past and ongoing exercises through use of control tasks link 488 within management links 480. Reporting links 482 within adminis-

11

trative interface **400** allow viewing of e-mail demographics, task status, and training metrics reports.

As shown in FIG. 4, classifications menu **484** for PMT **124** allows operators and administrators to select multiple phishing attack vectors for an exercise. Some exemplary attack vectors are provided in the exemplary classifications menu **484**. However, it is to be understood that the list of attack vectors shown in FIG. 4 is not exhaustive. These attack vectors can be further customized through addition of attachments in attachments window **486**.

FIG. 5 illustrates an exemplary web-based e-mail interface **590**, which can be used by a user associated with user account **132** to retrieve POP/IMAP e-mail messages **103** from e-mail server **122**. As shown in FIG. 5, a sample phishing e-mail message **592** can be displayed by e-mail interface **590** in the recipient's mailbox. The phishing e-mail message **592** displayed within e-mail interface **590** may include instructions to click on a seemingly innocuous phishing hyperlink **594**.

Upon determining that a user has selected phishing hyperlink **594**, the notification screen depicted in FIG. 6 can be displayed within browser **334**. As shown in phishing URL **696** of FIG. 6, embedded in phishing e-mail message **592**, user account **132** received a unique ID. Although the unique ID is shown in exemplary FIG. 6 as a 16-digit number as part of phishing URL **696**, in alternative embodiments, the unique ID may have a different length, form, or be passed as a separate parameter. When phishing hyperlink **596** is selected, the unique ID, the user account **132** receives immediate notification **698** of the training requirement. Notification **698** takes advantage of the "teachable moment" by immediately informing the user what was done incorrectly, why this is a threat, and what should be done differently in the future. Additionally, informational message **699** can be displayed to allow the user to contact the help desk, if he/she is suspicious that the page shown in FIG. 6 is not authentic. This gives the user a way to confirm that they need to take the training.

FIGS. 7-12 depict a simulated browser e-mail client interface **790** used as part of a phishing training exercise. According to an embodiment, simulated browser e-mail client interface **790** may be provided by training application **112** via web server **128**.

In the exemplary embodiment shown in FIG. 7, upon launching a browser session within browser **334** and logging into a user account **132**, a welcome message is displayed within dialog box **702** with instructions for the training exercise. FIG. 8 illustrates that a user can select a training e-mail message **804** displayed within simulated browser e-mail client interface **790**. As shown in FIG. 8, a cumulative score is displayed within interface **790** (in the exemplary display of FIG. 8, the cumulative score is 790 because the training exercise has just begun).

FIGS. 9-12 depict how (semi) randomly determined elements **904** of simulated phishing e-mail messages can be displayed within simulated browser e-mail client interface **790**. As shown in FIG. 9, for each of the (semi) randomly determined elements **904** of the e-mail message, the user is asked to click and categorize each as 'Neutral' or 'Suspicious' by selecting buttons in dialog box **906**. As illustrated in FIG. 10, correct and incorrect choices are explained in dialog box **1008**, which the user must acknowledge before proceeding with the training exercise.

FIG. 11 depicts how incorrect and correct phrases **1112** can be indicated within simulated browser e-mail client interface **790**. In the exemplary embodiment described in FIG. 11, incorrect phrases **1112** are highlighted in red and correct phrases **1112** are highlighted in green. As shown in FIG. 11, a number of remaining attempts and remaining phrases **1112**

12

can also be displayed in simulated browser e-mail client interface **790**. With continued reference to FIG. 11, a message **1110** informs the user whether he has selected enough correct phrases **1112**. In an embodiment, if not enough correct phrases have been selected and if this is the first attempt, the user may be told that he has not selected enough words and should try again. Alternatively, if this is the second attempt, a second message **1110** can be displayed, providing information that will help identify the phrases **1112** that should have been chosen. This message **1110** can also show points for the phrases that are correct. As shown in FIG. 12, after determining whether the training was completed successfully, either a congratulatory message **1214** or a further information message **1216** is displayed within simulated browser e-mail client interface **790**. In the exemplary embodiment of FIG. 12, the further information message **1216** can include information on how to identify incorrect phrases. If enough correct phrases **1112** have been selected, a congratulatory message **1214** is displayed. At this point, to finish the e-mail exercise, the user can select the "Other Actions" button **1212**.

Although exemplary embodiments have been described in terms of a computer implemented method or apparatus, it is contemplated that it may be implemented by microprocessors of a computer, such as the computer system **1300** illustrated in FIG. 13. In various embodiments, one or more of the functions of the various components may be implemented in software that controls a computing device, such as computer system **1300**, which is described below with reference to FIG. 13. The processor(s) of the computer system are configured to execute the software recorded on a non-transitory computer-readable recording medium, such as a hard disk drive, ROM, flash memory, optical memory, or any other type of non-volatile memory.

Aspects of the present disclosure shown in FIGS. 1-12, or any part(s) or function(s) thereof, may be implemented using hardware, software modules, firmware, tangible computer readable media having instructions stored thereon, or a combination thereof and may be implemented in one or more computer systems or other processing systems.

FIG. 13 illustrates an example computer system **1300** in which embodiments of the present disclosure, or portions thereof, may be implemented as computer-readable code. For example, system **100** and architectures **200** and **210** of FIGS. 1, 2A and 2B, can be implemented in computer system **1300** using hardware, software, firmware, non-transitory computer readable media having instructions stored thereon, or a combination thereof and may be implemented in one or more computer systems or other processing systems. Hardware, software, or any combination of such may embody any of the modules and components used to implement the system and architectures of FIGS. 1, 2A and 2B. Similarly, hardware, software, or any combination of such may embody modules and components used to implement the method of FIG. 3.

If programmable logic is used, such logic may execute on a commercially available processing platform or a special purpose device. One of ordinary skill in the art may appreciate that embodiments of the disclosed subject matter can be practiced with various computer system configurations, including multi-core multiprocessor systems, minicomputers, mainframe computers, computers linked or clustered with distributed functions, as well as pervasive or miniature computers that may be embedded into virtually any device.

For instance, at least one processor device and a memory may be used to implement the above described embodiments. A processor device may be a single processor, a plurality of processors, or combinations thereof. Processor devices may have one or more processor "cores."

13

Various embodiments of the present disclosure are described in terms of this example computer system **1300**. After reading this description, it will become apparent to a person skilled in the relevant art how to implement the present disclosure using other computer systems and/or computer architectures. Although operations may be described as a sequential process, some of the operations may in fact be performed in parallel, concurrently, and/or in a distributed environment, and with program code stored locally or remotely for access by single or multi-processor machines. In addition, in some embodiments the order of operations may be rearranged without departing from the spirit of the disclosed subject matter.

Processor device **1304** may be a special purpose or a general purpose processor device. As will be appreciated by persons skilled in the relevant art, processor device **1304** may also be a single processor in a multi-core/multiprocessor system, such system operating alone, or in a cluster of computing devices operating in a cluster or server farm. Processor device **1304** is connected to a communication infrastructure **1306**, for example, a bus, message queue, network, or multi-core message-passing scheme.

Computer system **1300** also includes a main memory **1308**, for example, random access memory (RAM), and may also include a secondary memory **1310**. Secondary memory **1310** may include, for example, a hard disk drive **1312**, removable storage drive **1314**. Removable storage drive **1314** may comprise a floppy disk drive, a magnetic tape drive, an optical disk drive, a flash memory, or the like.

The removable storage drive **1314** reads from and/or writes to a removable storage unit **1318** in a well known manner. Removable storage unit **1318** may comprise a floppy disk, magnetic tape, optical disk, etc. which is read by and written to by removable storage drive **1314**. As will be appreciated by persons skilled in the relevant art, removable storage unit **1318** includes a non-transitory computer usable storage medium having stored therein computer software and/or data.

In alternative implementations, secondary memory **1310** may include other similar means for allowing computer programs or other instructions to be loaded into computer system **1300**. Such means may include, for example, a removable storage unit **1322** and an interface **1320**. Examples of such means may include a program cartridge and cartridge interface (such as that found in video game devices), a removable memory chip (such as an EPROM, or PROM) and associated socket, and other removable storage units **1322** and interfaces **1320** which allow software and data to be transferred from the removable storage unit **1322** to computer system **1300**. Computer system **1300** may also include a communications interface **1324**.

Communications interface **1324** allows software and data to be transferred between computer system **1300** and external devices. Communications interface **1324** may include a modem, a network interface (such as an Ethernet card), a communications port, a PCMCIA slot and card, or the like. Software and data transferred via communications interface **1324** may be in the form of signals, which may be electronic, electromagnetic, optical, or other signals capable of being received by communications interface **1324**. These signals may be provided to communications interface **1324** via a communications path **1326**. Communications path **1326** carries signals and may be implemented using wire or cable, fiber optics, a phone line, a cellular phone link, an RF link or other communications channels. In this document, the terms "computer program medium," "non-transitory computer readable medium," and "computer usable medium" are used to generally refer to media such as removable storage unit

14

1318, removable storage unit **1322**, and a hard disk installed in hard disk drive **1312**. Signals carried over communications path **1326** can also embody the logic described herein. Computer program medium and computer usable medium can also refer to memories, such as main memory **1308** and secondary memory **1310**, which can be memory semiconductors (e.g. DRAMs, etc.). These computer program products are means for providing software to computer system **1300**.

Computer programs (also called computer control logic) are stored in main memory **1308** and/or secondary memory **1310**. Computer programs may also be received via communications interface **1324**. Such computer programs, when executed, enable computer system **1300** to implement the present disclosure as discussed herein. In particular, the computer programs, when executed, enable processor device **1304** to implement the processes of the present disclosure, such as the stages in the methods illustrated by the message sequence chart **300** of FIG. **3**, discussed above. Accordingly, such computer programs represent controllers of the computer system **1300**. Where the present disclosure is implemented using software, the software may be stored in a computer program product and loaded into computer system **1300** using removable storage drive **1314**, interface **1320**, and hard disk drive **1312**, or communications interface **1324**.

Embodiments of the present disclosure also may be directed to computer program products comprising software stored on any computer useable medium. Such software, when executed in one or more data processing device, causes a data processing device(s) to operate as described herein. Embodiments of the present disclosure employ any computer useable or readable medium. Examples of computer useable mediums include, but are not limited to, primary storage devices (e.g., any type of random access memory), secondary storage devices (e.g., hard drives, floppy disks, CD ROMs, ZIP disks, tapes, magnetic storage devices, and optical storage devices, MEMS, nanotechnological storage device, etc.), and communication mediums (e.g., wired and wireless communications networks, local area networks, wide area networks, intranets, etc.).

It is to be appreciated that the Detailed Description section, and not the Summary and Abstract sections, is intended to be used to interpret the claims. The Summary and Abstract sections may set forth one or more but not all exemplary embodiments of the present disclosure as contemplated by the inventor(s), and thus, are not intended to limit the present disclosure and the appended claims in any way. Embodiments of the present disclosure have been described above with the aid of functional building blocks illustrating the implementation of specified functions and relationships thereof. The boundaries of these functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternate boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed.

The foregoing description of the specific embodiments will so fully reveal the general nature of the present disclosure that others can, by applying knowledge within the skill of the art, readily modify and/or adapt for various applications such specific embodiments, without undue experimentation, without departing from the general concept of the present disclosure. Therefore, such adaptations and modifications are intended to be within the meaning and range of equivalents of the disclosed embodiments, based on the teaching and guidance presented herein. It is to be understood that the phraseology or terminology herein is for the purpose of description and not of limitation, such that the terminology or phraseol-

15

ogy of the present specification is to be interpreted by the skilled artisan in light of the teachings and guidance.

The breadth and scope of the present disclosure should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

What is claimed is:

1. A computer-implemented method for identifying and mitigating information security risks, the method comprising:

assigning unique identifiers to a plurality of target e-mail addresses, wherein each e-mail address is associated with an individual user account, respectively;

delivering an e-mail message to one or more of the plurality of target e-mail addresses, wherein the e-mail message comprises a hypertext transfer protocol (HTTP) request and a unique identifier associated with a user account;

receiving, at a Phishing Metric Tool (PMT), a response including the unique identifier;

logging, by the PMT, a training requirement for the user account;

tracking, by the PMT, response metrics for the training requirement;

redirecting the HTTP request to a phishing training tool (PTT);

sending, by the PTT, a notification of a verified identity of the user account and the unique identifier to the PMT;

returning a status report for the training requirement, the status report including an indication of whether the user account has failed at least a portion of the training requirement; and

redirecting, by the PMT, the user account to undergo an additional training requirement related to the portion of the training requirement which was failed, upon receipt of the status report, when the status report indicates that the user account has failed at least the portion of the training requirement so that the user account is subjected to the additional training requirement,

wherein the PMT and the PTT are respectively implemented by at least one processor of a computer processing device.

2. The method of claim 1, wherein each target e-mail address is associated with a user account in an organization, and a training exercise is associated with the training requirement for the user account respectively associated with the target e-mail address.

3. The method of claim 2, further comprising: updating, by the PMT, the status of the training requirement,

wherein the status is based at least in part on the tracked response metrics.

4. The method of claim 3, wherein the status indicates at least one of:

a response to the e-mail message has not been received; the training exercise is underway;

the training exercise has been completed unsuccessfully; the training exercise has been completed successfully;

a certificate for a successfully completed training exercise has been generated; and

a notification for a completed training exercise has been sent.

5. The method of claim 4, wherein the notification is an e-mail message sent to the target e-mail address.

16

6. The method of claim 4, further comprising:

sending a reminder notification to the target e-mail address in response to determining that the user account has not completed information security training within a pre-determined period of time.

7. The method of claim 4, wherein the notification is an e-mail message sent to an administrator e-mail address associated with a system administrator of the organization.

8. The method of claim 7, further comprising:

sending a reminder notification to the administrator e-mail address in response to determining that the user account has not completed information security training within a pre-determined period of time.

9. The method of claim 2, further comprising:

receiving, at the PTT, credentials for the user account; validating, by the PTT, the credentials for the user account; and

verifying a login to the user account based upon the validated credentials; and

sending a start exercise message for the training exercise based upon verifying the login.

10. A non-transitory computer readable storage medium having program instructions stored thereon for identifying and mitigating information security risks, the instructions being executable by a processor of a computing device, the instructions comprising:

instructions for receiving, at a phishing metrics tool (PMT), a phishing hypertext transfer protocol (HTTP) request;

instructions for sending a redirect message from the PMT to a browser session;

instructions for receiving, at a phishing training tool (PTT), a request for an application, wherein the request is based at least in part on the received phishing HTTP request;

instructions for sending, from the PTT to the browser session, the requested application;

instructions for sending, from the PTT, a start message for a first training requirement;

instructions for sending, from the PTT, a training exercise associated with the first training requirement;

instructions for returning a status report for the first training requirement, the status report including an indication of whether at least a portion of the first training requirement has been failed; and

instructions for redirecting, by the PMT, the browser session to undergo an additional training requirement related to portion of the first training requirement which was failed, upon receipt of the status report, when the status report indicates that the at least the portion of the first training requirement has been failed so that a user using the browsing session is subjected to the additional training requirement.

11. The non-transitory computer readable storage medium of claim 10, wherein the instructions further comprise:

instructions for determining whether the training exercise has been completed; and

instructions for generating a completion message in response to determining that the training exercise has been completed.

12. The non-transitory computer readable storage medium of claim 11, wherein the instructions further comprise:

instructions for sending the completion message from the PTT to the PMT in response to determining that the training exercise has been completed.

13. The non-transitory computer readable storage medium of claim 10, wherein the training exercise is an ADOBE™ Flex application.

17

14. The non-transitory computer readable storage medium of claim 10, wherein the training exercise is an ADOBE™ Flash application.

15. The non-transitory computer readable storage medium of claim 10, wherein the training exercise is an HTML5 application. 5

16. A system capable of identifying and mitigating information security risks, the system comprising:

a phishing metric tool (PMT) configured to:

receive a phishing hypertext transfer protocol (HTTP) request from a browser session; and 10

send a redirect message to the browser session, the redirect message redirecting the browser session to a phishing training tool (PTT);

an e-mail server configured to: 15

send an e-mail message to a target user account, wherein the e-mail message is based on the phishing HTTP request, and wherein the e-mail message includes a unique identifier; and

receive a response from the target user account, wherein the response includes the unique identifier; 20

wherein the PTT is configured to:

receive an application request based on the response;

send the requested application to the browser session;

send a start message for a training requirement for the target user account; 25

send a training exercise associated with the training requirement;

send a notification to the PMT of an identity of the target user account and the unique identifier; and

18

update a status of the training exercise, the status of the training exercise including an indication of whether the user account has failed at least a portion of the training requirement,

wherein the PMT is configured to redirect the user account to undergo an additional training requirement related to portion of the training requirement which was failed, upon receipt of the status, when the status indicates that the user account has failed at least the portion of the training requirement so that the user account is subjected to the additional training requirement, and

wherein the PMT and the PTT are respectively implemented by at least one processor of a computer processing device.

17. The system of claim 16, wherein the PTT is in a trusted domain associated with an organization and wherein the target user account is associated with the organization.

18. The system of claim 17, wherein the PMT is in an untrusted domain external to the organization comprising at least one web server and one or more distributed phishing agents.

19. The system of claim 16, wherein the PMT is further configured to send a reminder notification in response to determining that the training exercise has not been completed within a designated time period.

20. The system of claim 16, wherein the PTT is further configured to send a completion notification in response to determining that the training exercise has been completed.

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